# AMRAD NEWSLETTER

**AMATEUR RADIO RESEARCH AND DEVELOPMENT CORPORATION**

*P.O. Drawer 6148* *McLean, VA. USA 22106-6148* Vol. XVII - No. 4


# Calendar

Meetings are normally held on the second Thursday of each month at the Dolley Madison Library in McLean, Virginia starting at 7 p.m.

AMRAD publishes six Newsletters a year (on the first weekend of each odd-numbered month). Authors are encouraged to submit their copy by the first weekend of even-numbered months for the next Newsletter. Please submit your copy to: Editor, AMRAD Newsletter, P.O. Box 6148, McLean, Virginia 22106-6148.

**COMING MEETINGS:**
**THURSDAY NOVEMBER 8**
**THURSDAY DECEMBER 13**
**MARK YOUR CALENDARS!**

# The President's Ramblings

by André Kesteloot N4ICK

### Good News Dept. - A New Generation of Hams? - The Phone Phixer - A New HF Modem Protocol.

### Good News Department:

The other day, while in a pensive mood, I was pondering about the rather melancholy state of affairs as regards the World in general and our own micro-world of radio experimenters in particular, when Rollo (my butler) brought me the afternoon mail, including a letter from Richard Rathburn KB6NQ. The letter did much to dispel at least part of my gloom, and here is why: Richard owns/runs a company called

R & R Associates,
3106 Glendon Avenue,
Los Angeles, CA 90035
(213) 474-1315

which sells all sorts of goodies for the kind of people who (like you Dear AMRAD Newsletter Reader) have a physical addiction to tinkering with interesting radio projects. Now if you, as an experimenter, have recently tried to obtain one or two (as opposed to 500) esoteric ICs from your local Motorola distributor, you will know what "instant aggravation" can mean... Anyway, Richard's company manufactures small printed circuits for all sorts of projects described in the ARRL Handbook and in other publications, including the Motorola Application Notes, Radio Electronics, Ham Radio, 73 and CQ Magazine. His list presently includes about 50 different kits. (You may recall that in the January 1990 issue of this Newsletter, I had described a VCO based on the fact that HCT chips evidence a propagation delay inversely proportional to Vcc. Well, R&R Associates have produced a small printed circuit board and a kit of parts for $6 postpaid, or the board alone for $2 postpaid. I mean, what, you cannot go wrong!) They also have a large assortment of Motorola and other useful integrated circuits, monolithic resonators, varicaps, MMICs, etc. Write to R&R Associates and ask for their price list; I think you will be impressed and will want to support this kind of small firms, by purchasing your parts from them. That's what they are in business for: cater to the needs of the radio experimenter.

### A New Generation of Hams?

At one of our regular ASTMs (AMRAD Saturday Taco Meetings), Paul Rinaldo W4RI (former President of AMRAD and presently Editor of QST) and I were discussing the other week the direction in which our hobby is generally heading, and we agreed – at least I think we did – that our own "Old-Timer" passion for radio could be traced down to at least two separate factors: (a) the excitement of listening to distant, and possibly foreign voices, and eventually succeeding in communicating with them, and (b) the thrill of building our own equipment. By and large, long distance communications have become common-place for today's youngster, surrounded as he/she is by color TV, satellites and cellular phones. When it comes to "rolling your own," when was the last time you saw one of your non-AMRAD friends build a transmitter? If the only stimulation ham radio has to offer is to use your factory-made 2-meter hand-held radio to make an autopatch and ask your mate what you need to pick-up at the supermarket, who needs ham radio? My cellular phone works better than that anyway!

Now, clearly, we cannot recreate for the new generation the old thrill of short-wave, long-distance communications discovery. As we said, it has been superseded by other modes of instant communications. But what about the other thrill, that which comes of building something, and the satisfaction of making it work? There is where, Paul and I think, much can be done. Our secret plot is the following: offer high-

school kids the opportunity to discover radio/ electronics/ communications by making available some kits of parts which will allow them, for instance to receive transmissions from satellites, to communicate between computers, or to build simple transmitters and receivers. Who will help us financially? I would imagine electronic giants, such as IBM or Motorola or Texas Instruments, who are regularly deploring the fact that in a few years there won't be enough electronics engineers left for industry to prosper. What we need from you Dear Reader, are suggestions on what kind of kits tomorrow's children would enjoy. (Can you believe that in most high-schools today in 1990, if you take a "shop" course you will be taught how to weld iron plates and carve wooden objects? These are good skills, to be sure, but when was the last time you needed to weld something in everyday life? What about, instead, an introduction to electronics? Besides, I firmly believe that it is not enough to simply tell youngsters : "just say no"; you also have to suggest an exciting alternative.) So, Paul Rinaldo and I concluded that the ARRL and AMRAD should probably cooperate in this low-tech, but high-yield project. I have already started on the design of a 180KHz (FCC part 15) transmitter and receiver. What would *you* like to contribute? From simple ideas to complete designs, all your suggestions will be equally welcome. Do drop a line to either Paul or myself, listing your recommendation(s) and you will know that you will have done something that could well turn out to be terribly useful to the scientific and economic future of this country.

**The Phone Phixer:**

One of the things I find particularly exasperating is the following: our phone rings and Rollo, my butler, fails to pick it up before the fourth ring. The answering machine then embarks in its mindless act ("Hellowww, there is no-one to answer you right now, but if you leave your name etc...") and I find myself rushing to grab the nearest of our six phones (thinking it could be Ed McMahon or one of my rich uncles) and shouting louder than the machine: "Wait, don't hang up!" Hence the need for a more elegant solution to instantly silence the infernal doohickey.

Another problem, ranking a little lower on my exasperation list, is that when your household includes not only the Significant Other (as they say these days) but also two socially (hyper)active teen-agers and six phones, you always find yourself answering the Thing on behalf of someone else. This is where a ubiquitous "hold" button would come in handy.

In comes my "Phone Phixer." Figure 1 gives an idea of the general arrangement, while figure 2 gives the schematic. Referring to figure 2, when the phone is on hook, the voltage on the red wire is about -48volts DC (nominal), the LED inside opto-isolator U1 is lit, the associated phototransistor conducts and its collector is thus near ground potential. Any AC ringing voltage superimposed on the -48v will not be able to reach U2 pin5 because of the integrator network (composed of the 4.7 MΩ and 0.1 $\mu$ Fd) inserted between U2a and U2b, two sections of a CMOS quad Schmitt trigger. Now if my answering machine picks up (or a phone is picked-up, i.e., goes off hook), the DC voltage across the phone line will drop from -48 vDC to approximately -6vDC, the opto-isolator LED will extinguish, the phototransistor will stop conducting, U2 pin1 will go to +5v, the 0.1 $\mu$ Fd capacitor at U2 pin 5 will discharge to ground, and U2b pin4 will go to +5v, bringing transistor Q1 into saturation, and operating relay K1. This relay connects input transformer T1 to the telephone line. Any touch-tone now present on the line will be transferred to U3, a SSI202 DTMF CMOS receiver/decoder (Radio-Shack # 276-1303). U3 detects any standard touch-tone, and because its pin 2 is tied high, the output of U3 is in 4-bit hexadecimal format. This code is then further passed to U4, a 74154 one-of-sixteen data distributor. Note that, to force all U4 outputs to "1" when no valid input is present, the DV line (pin 14 of U3) is inverted and connected to both Data Input and Enable (pins 18 and 19) of U4 . The selected output of the 74154 is "active-low," thus if the "*" is pressed on any phone on the line, the corresponding pin (pin 13) will go low, and trigger U5, a one-minute 555 monostable, the output of which drives into saturation transistor Q3, thus operating relay K2. This relay disconnects the telephone line going to the phone-answering machine, which now resets itself (and instantly interrupts its inane message to my correspondent).

Now, if instead of the "*" key, I were to press the "#" key, pin 14 would go low, and this would trigger U6, another 555 connected as a 5-second monostable. The latter operates relay K3, which momentarily shorts together the anode and the trigger of SCR Q5 and thus drives this SCR into conduction. This SCR then places a 1.2 KΩ resistor across the phone line. If, within 5 seconds of after having pressed "#", I hang up my phone, this 1.2K resistor will still draw enough current from the telephone central office to keep my line connected. My line is thus now "on hold." If any phone in my home is subsequently picked-up (i.e., goes "off hook"), that phone's 600 Ω termination will appear in parallel with the

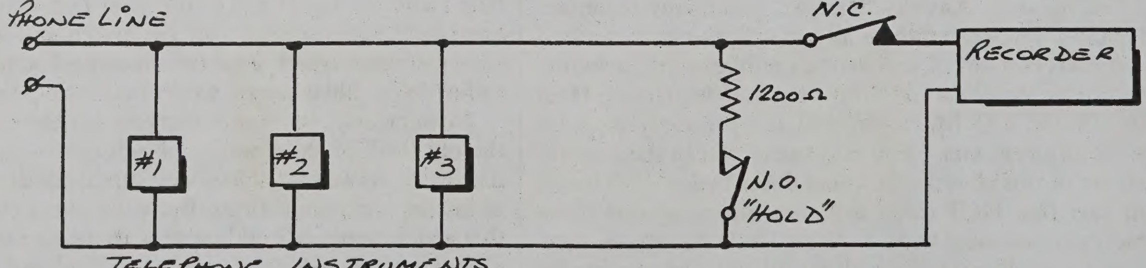
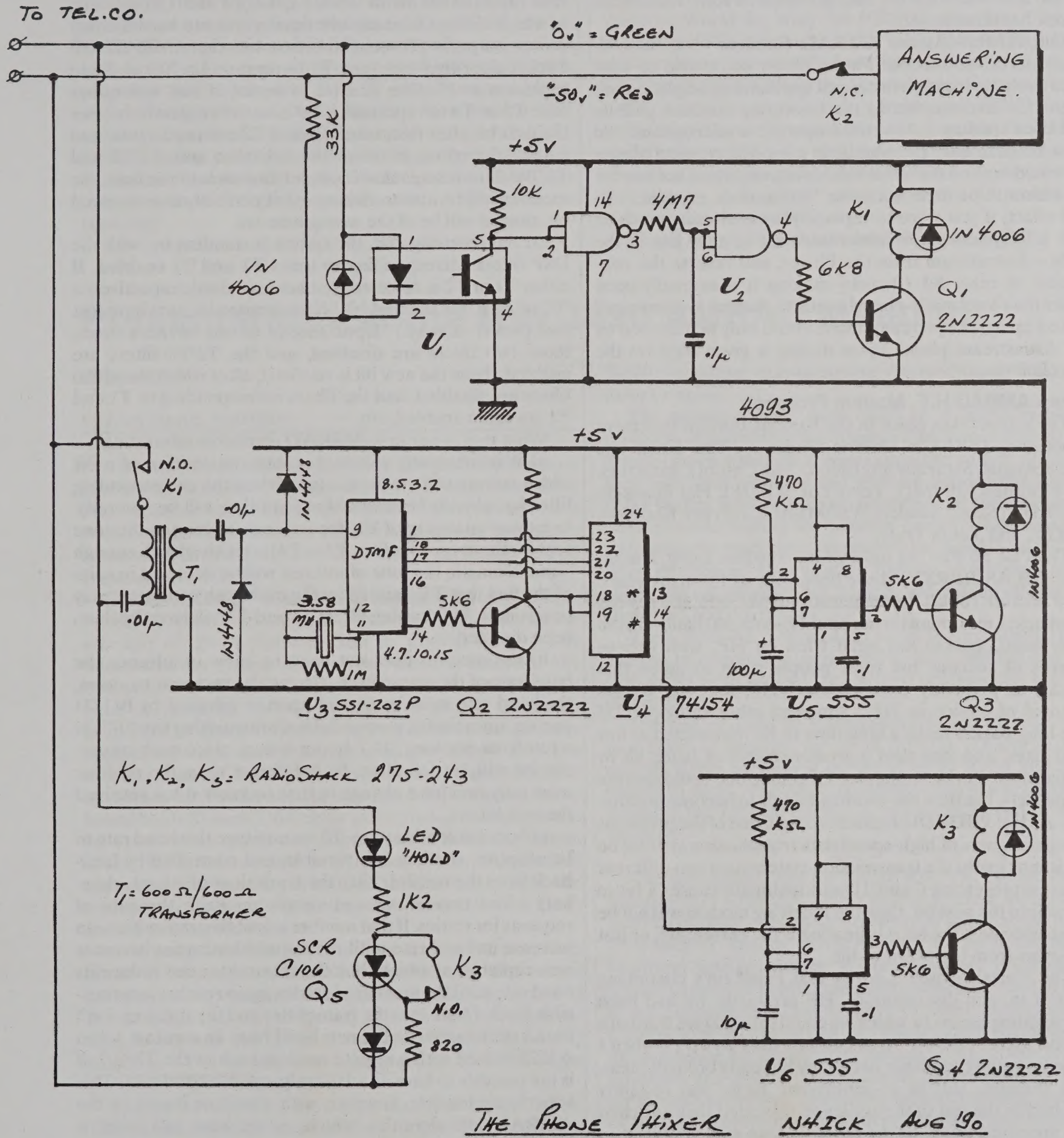



FIG 1 THE PHONE PHIXER



TO TEL.CO.
"0v" = GREEN
"-50v" = RED
ANSWERING MACHINE.
N.C.
K2
33K
+5V
10K
14
4M7
1
2
5
3
4
6
7
K1
1N4006
1N 4006
6K8
U2
Q1
2N2222
U1
.1μ
4093
+5V
N.O.
K1
1N4148
8.5.3.2
.01μ
9
DTMF
1
18
17
16
T1
3.58 MH
12
11
5K6
14
4.7.10.15
1M
24
23
22
21
20
18
19
12
*
#
13
470 KΩ
K2
8
5K6
3
100μ
.1
1N4006
U3 SSI-202P
Q2 2N2222
U4 74154
U5 555
Q3 2N2222
K1, K2, K3 = RADIOSHACK 275-243
+5V
470 kΩ
K3
1N4006
LED "HOLD"
T1 = 600Ω/600Ω TRANSFORMER
1K2
SCR C106 Q5
K3
N.O.
820
10μ
U6 555
Q4 2N2222
THE PHONE PHIXER
N4ICK AUG '90

1.2KΩ/SCR series combination and will starve the SCR, which now will turn off and go open-circuit. The Phone Phixer has done its job.

Our AARs—Astute AMRAD Readers—will have already perceived that the Phone Phixer could also be used from a remote location to control appliances/gadgets in their home; for instance, letting the answering machine pick up and then sending a "1" could operate a microphone and allow them to hear the sounds in a specific room; dialing a "2" could turn on the air-conditioning, etc. Another way for the Phixer to be used is a as an "access code machine." To that effect, if you were to replace your answering machine with a telephone set—subscriber's set as they say in the trade—downstream from the Phixer, and reverse the connection at relay K1 (thereby making it a normally-open rather than a normally-closed contact), then an incoming call picked up by an upstream phone could only be received by the downstream phone upon dialing a given digit on the upstream one.

**A New AMRAD H.F. Modem Protocol:**

The action takes place in the Famous Borden Basement Laboratory (BBL) in Oakton Virginia. The Time: one recent August Saturday afternoon. The Cast of Characters: Dave Borden K8MMO, Terry Fox WB4JFI, Hal Feinstein WB3KDU, Sandy Sanders WB5MMB, Lawrence Kesteloot N4NTL, and Yours Truly.

The Plot So Far: As most of our readers know, Amtor, Sitor and ASCII RTTY have been with us for many years. They provide robust communication links with one serious drawback: a maximum throughput of about 300 baud. On the other hand, packet has been tried on HF, with various degrees of success, but most people seem to agree that AX.25, as presently practiced in VHF, may not be the protocol of choice in HF. Amongst other things, a 255 byte-long packet takes a long time to be transmitted at low baud rates, and thus runs a greater chance of being hit by propagation quirks, static, etc. Of course one could shorten the packets, but then the overhead tends to become prohibitive. As Hal WB3KDU explains so well, one of the problems facing designers of high-speed data transmission systems on HF is multipath: if a transmission system uses two different tones (representing 0 and 1), and multipath causes a bit to smear into the next bit, then the receiving modem will not be able to decide if the bit it is hearing is the current bit, or just left-overs from the previous bit.

The Curtain Rises: Led by Hal Feinstein's continuing interest in, and discussion of, HF protocols, we had been investigating means by which we could satisfy Dave Borden's second secret passion, "transmit fast data on HF," when I came up with yet another one of my bi-yearly brilliant ideas. This thought, still in its embryonic form, was instantly grabbed by the rest of the audience, dissected then enriched and improved upon, to the point that we may now want to refer to it as the new AMRAD HF Protocol. (That is, if it works as well as we hope. If it does not work, it will be remembered by future generations as the André protocol.) So here it is.

Let's assume a transmitting system capable of generating four (4) different audio tones T1, T2, T3 and T4 (only one of which will be ON at any one time in order to maximize my power output). To send the first bit, the AMRAD HF Packet algorithm uses tone T1 to represent a "0", or T2 to represent a "1". The next bit, however, is sent with either tone T3 or T4 to represent a "0" or a "1" respectively. For the next bit after that, tones T1 and T2 are used again, and so on, alternating between the two tone sets T1/T2 and T3/T4. This insures that if one bit smears into the next, the receiver will be able to distinguish it perfectly as a smeared bit, since it will be of the wrong tone set.

At the receiving end, the system is standing by, with the DSP filters corresponding to tones T1 and T2 enabled. If either T1 or T2 is detected, you have received respectively a "0" or a "1" for the first bit. (If you missed it, you have lost that packet anyway.) Upon receipt of one of these tones, those two filters are disabled, and the T3/T4 filters are enabled. Now the new bit is received, after which these two filters are disabled, and the filters corresponding to T1 and T2 are again enabled, etc.

What makes our new AMRAD algorithm interesting?

a) it is inherently robust, because the portion of a bit which smears will arrive at a time when the corresponding filter has already been disabled (and thus will be ignored). In case of smearing of T1, for instance, as long as the tone sent for the second bit (i.e., T3 or T4) is received with enough signal strength, the tone of interest will be detected in spite of the fact that T1, created by the multipath condition, may be stronger, as receiving filters T1 and T2 will have, by then, been disabled.

b) the receiver does not need to know in advance the baud-rate of the transmitter. (In regular two-tone modems, the baud rate must be agreed upon in advance by BOTH parties, since timing is essential in distinguishing two "1"'s in a row from one long "1".) In our system, since each successive bit will, by definition, be a different tone, the receiver must only wait for a change in tone to know it has received the next bit.

c) because of advantage (b) we envisage this baud rate to be adaptive, continuously variable, and controlled by feedback from the receiver site (the equivalent of a back-channel). The transmitter can simply measure the rate of requests for retries. If that number is low, the transmitter can increase its baud rate until the request for retries becomes unacceptable, at which time the transmitter can reduce its baud rate until the number of retries again reaches a permissible level. (Note that the transmitter and the receiver don't even have to agree on the new baud rate. In contrast, when AX.25 is used with a regular modem such as the TNC-2, it is not possible to have an adaptively variable baud rate. This is perfectly feasible, however, with a modem based on the AMRAD HF algorithm which, as we have just seen, is protocol-independent.)

Where are we right now? I have already built two different boards, either of which can generate the four audio tones mentioned above. These boards are controlled by my laptop, and drive my 2-meter rig (prudent, we are trying the scheme first on VHF!) Lawrence N4NTL has written the software

which does the transmitter-side magic just described. Incidentally, that software allows us to insert controllable amounts of smearing for evaluation purposes. If you are within the range of the AMRAD 2-meter repeater, you can hear from time to time our strange combinations of tones, preceded and followed by my CW identification. Meanwhile, Terry Fox and David Borden have written DSP software capable of detecting the famous tones, while Sandy Sanders brings us back to sanity by regularly reminding us that infinitely narrow filters (a great temptation in DSP) can only lead to an infinitely low data rate. Anyway, we are cooking!

### Stop The Press!

Alas, since I wrote the above, I have received a copy of Wireless World for May '90 ("RF Connections," by Pat Walker, p. 450), and you probably won't believe this, but the above scheme has already been invented once! Not only invented, but patented by the Decca Radar Company in the 1960s. According to the article, which quotes H.E.Dempsey of Threshold Comunications (Ontario, Canada) the scheme works quite well. So, the good news is that we did not come up with a bogus scheme! AMRAD's future contribution may thus be to find DSP solutions to the old problem of "sending fast data on HF."

73 and Happy Hamcomputing DE André N4ICK.

# Presentations at the May 1990 AMRAD Meeting

### A Synopsis

by Dick Barth, W3HWN

The May tenth meeting was held at the Dolly Madison Library in McLean. It began with an announcement from Hal Feinstein that a future meeting would see a talk by Frank McDermott. He is an air crash investigator who specializes in the analysis of data in the "black boxes" carried aboard all commercial aircraft.

There followed a presentation by Chuck Phillips, N4EZV. Chuck is working a system which permits the storage of audio information in digital form. The demonstration system seen at the meeting recorded the output of an FM receiver, stored it in RAM, and played it back on demand. It was arranged to store a maximum frequency of about 3300 Hz—appropriate for an amateur application—and had a storage capacity of over fourteen minutes of audio. With a full complement of memory boards its storage can be extended to over four hours. Each memory board holds 33 each 256K chips and up to sixteen boards can be used. With a full complement of memory the system draws 5.6 mA in record or playback mode. A switched capacitor filter uses 2 mA by itself. In quiescent mode, the total power load is about a microwatt, so it will work easily from a hearing aid battery.

It is programmable to store data at rates varying from about 7500 bps up to about 128 kilobits/second. The record and playback speeds are independent; data can be recorded at one speed and played back at another with full equalization. Up to four 600 Ω inputs can be handled, with priority handling. The system uses Continuously Variable Slope Delta (CVSD) modulation.

Except for two chips, the design uses 4000-series CMOS. This was done because commercial sources exist for machine design of Application Specific Integrated Circuits (ASICs) containing up to 35 standard chips. Design is easier if this type of CMOS is used. Chuck has already used this approach in the design of a spread spectrum transmitter. He had it built into a chip 1.25 by 1.25 by 0.1 inches for a total of $6600, including non-recurring engineering (NRE) and three samples.

The system can be used easily in a single-frequency repeater. Received carrier triggers it into record mode and it takes down whatever it hears until the carrier drops. It then keys its transmitter and after an appropriate turn-on delay dumps whatever it just recorded. It then returns to passive mode waiting for another carrier. The complete system can be made small enough to be taped to an HT and lifted into the air by a weather balloon, providing a wide-range instant repeater for search and rescue efforts and similar ad hoc operations.

The system will record either audio or direct digital data, and can be remotely programmed to store until full and then stop, or to wrap around (i.e., record continuously over the oldest data).

The system could be marketed today as a kit, with a full four hours of memory, for about $16,000. This price is, of course, highly dependent on the price of RAM and is expected to drop. The ASIC controller chip will probably be available for 150-200 dollars in quantities of two or three hundred.

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The next speaker was Joe Novak, K4OVK. He and Glenn Baumgartner KA0ESA have a shared interest in satellites, and this evening's discussion concerned applications of the INMARSAT system. INMARSAT is the International Maritime Satellite system, a global network originally intended to provide public communications from land to ships at sea. It began in 1975 as MARISAT with twenty channels. Currently the system carries over two hundred channels, and its application has expanded to include both portable ground terminals and airborne applications. Journalists use them for live interviews with overseas figures, and various agencies of the U.S. government use them for situations requiring rapid deployment of communications.

Joe noted that the Armed Forces Radio and Television Service (AFRTS) has for years provided U.S. Forces overseas with American radio programming material by transmitting it to overseas broadcasting stations via HF. Today,

radio programming is carried via INMARSAT rather than HF, making it available to anybody with a suitable satellite receiver. The demonstration receiver Joe brought along used a three foot dish which was parked outside in the parking lot. Joe noted that the military is paying $5500 dollars per receiver and making them available on ships and at other remote locations that don't have normal AFRTS distribution. U.S. citizens living overseas who are not eligible for federally funded receivers are permitted to buy their own, but the price makes them unavailable for many prospective users.

Joe's current project involves the design of a simple INMARSAT receiver that will permit the reception of AFRTS audio programming at reasonable cost by Americans overseas. He's looking for assistance in the design of the hardware, and anybody with the interest and ability is invited to contact him.

The uplink from the INMARSAT primary ground station is at 6.2 GHz and downlinks to ships are in the 1.536-1.546 GHz band. The reverse links go up from the ships at 1.6-1.64 GHz and down at about 4 GHz.

# Some Awfully Simple Thoughts on Detectors

by Hal Feinstein WB3KDU

In a receiver, after a radio signal has been amplified and filtered, there still remains the problem of recovering what it was that was transmitted in the first place. This means the information, which was transmitted by altering the carrier in some manner. Detection is the opposite problem: removing the information from the carrier. Because this is going to depend upon how the information was originally placed upon the signal, detection methods are going to be different.

The first idea that comes to mind is detecting the presence of signal. CW uses this form of modulation, breaking the signal to create symbols of different lengths. A simple detector for CW measures the CW signal strength and compares it against the noise in the background. So if the signal to noise ratio is large enough it is possible to decide that the observed signal differs from the background noise by a set amount known as a threshold.

Everything is fine until the signal begins to fade and our simple detector cannot decide what is signal and what is noise. When this happens the signal to noise ratio is not sufficient to get a good decision and lots of bad decisions creep in. Bad decisions are of two types. The first says there is signal present when in fact there isn't. The second type of error says there's no signal reaching the receiver when in fact one is being transmitted. Either way, the output of the decision circuit is going to be full of noise. We aren't going to be able to discover if a dot or dash was sent.

So we search for a way to improve the detector and of course, being scientists, we find one. What we discover is that we don't need to make a decision at the end of every sample (happening thousands of times a second) but at the end of a cleverly chosen time interval. We choose the time interval so that multiples of it make up a good dash or dot or space.

Now when the signal to noise ratio begins to fall and the decision circuit can't make up its mind, we count the number of "yes" (there is a signal) vs. "no" (there is no signal) votes and go with the clear majority in each time interval. We can get clever too.

Recall that we are counting votes in an interval and going with the majority. Suppose we make up a table (in the computer) that tells us how long each type of symbol is: dash, dot and space. When the decision circuit begins telling us how the voting is going in each interval, we match this voting record against each symbol in our table. When we find a sequence of intervals that matches a symbol in our table, we decide that symbols must have been sent. Let's illustrate this process with a toy example.

In line 1 is the output of the decision circuit with noise. Line two below shows how the majority voting within an interval improves our estimate of what was really set.

Line 1: 0001000100 1110111001 1110110001 1111111011 0000010001 00010000110

Line 2: "No" "Yes" "Yes" "Yes" "No" "No"

Line 1 and 2 correspond to our original idea of taking the majority. Next, we illustrate how we reapply this same concept to get an even better estimate of what was sent. For simplicity let us use the digit 1 for YES and the digit 0 for NO. This lets us re-code line 2 in just 1's and 0's shown in Line 3:

Line 3: 0 1 1 1 0 0

The last step of this procedure requires us to match what we have so far in Line 3 against the description of the CW signal elements in our dictionary. This is illustrated below.

Example CW Signal Element Dictionary
DOT-element 0 1 1 1 0.
DASH-element 0 1 1 1 1 1 1 1 1 1 0.
SPACE-element 1 0 0 0 0 0 0 1.

Sliding each signal element's definition against Line 3 reveals that DOT-element is the best match and this allows us to feel sure that DOT was actually the symbol transmitted. This procedure gives us a lot of noise immunity.

However, there are some problems that we face with this procedure. Lets illustrate them now. First, consider what happens when the signal to noise ratio goes way down. When this happens mathematics tell us that the decision circuit will report approximately 50% ones and 50% zeros. Our majority vote procedure is blinded by such output and it too reports 50% "Yes" and 50% "No." We cannot use our procedure in such circumstances. However, with a modest rise in the signal to noise ratio our procedure once again regains its noise "immunity."

Lets take a closer look at what happens when the signal to noise ratio falls and we get erratic results from our detection procedure. One thing we see is that the majority vote of the decision circuit itself yields errors. The amount of such

error is a function of the signal to noise ratio. When this happens we get erroneous data to try to match against our signal element dictionary and we either match the wrong symbol or we can find no signal element to match at all.

Lets try to solve this by applying majority vote to the output of the decision circuit/majority voter previously described, except that now we are going to look for a majority vote against the definition of each signal in the signal dictionary. If the majority is "for" the choice we will elect to take it. If on the other hand a majority is "against" the symbol's choice then we repeat the majority voting procedure on the next symbol in the dictionary.

The majority voting procedures provide us with some noise immunity. We will find however that the use of morse code elements is not optimal and we will find cases were we cannot decide which symbol to select. Another code, called the Moore code was actually designed to optimize the majority decoding procedure. We will explore these in a later issue.



## AMRAD MEMBERSHIP APPLICATION/RENEWAL

*Mail to: Membership, AMRAD, P.O. BOX 6148, McLean, Va. 22106-6148*

ANNUAL DUES: Regular $15; 2nd in family at same address add $8; Canada and Mexico add $2; foreign surface add $2.30; foreign air mail add $8; currency is US dollars. A donation to the WD4IWG/R repeater fund is appreciated if you use the repeater. Please make checks payable to AMRAD.

Name________________________ Amateur Call__________ License Class________

Street Address________________________________________ Apt#________

City________________________ State/Prov____________ ZIP/PC__________

Country______________ Home Phone (___)____-_____ Work Phone (___)____-_____

Special Interest Groups: please indicate your interest.

__Deaf Communications __RTTY __Spread Spectrum __Packet Radio __Digital Signal Processing

Network: CompuServe ID:__________

__________ ID:__________

Packet Radio mail box ____________ ARRL member?____

## AMRAD

The Amateur Radio Research and Development Corporation (AMRAD) is a worldwide club of several hundred amateur radio and computer experimenters. It is incorporated in Virginia and is recognized by the U.S. Internal Revenue Service as a tax-exempt scientific and educational organization.

## AMRAD's Purpose

The purpose of AMRAD is to: develop skills and knowledge in radio and electronic technology; advocate design of experimental equipment and techniques; promote basic and applied research; organize technical forums and symposiums; collect and disseminate technical information; and provide experimental repeaters.

## Meetings

Meetings are held on the second Thursday of each month at 7:00 P.M. at the Dolley Madison Library in McLean, Virginia. If the second Thursday is a holiday, an alternate date will be announced in the newsletter. Except for the annual meeting in December, meetings are reserved for technical talks - not business.

## WD4IWG Repeater

WD4IWG/R is an open repeater for FM voice and digital communications, especially for experimental modes. It is located in McLean, VA. It features an autopatch available to licensed members. Frequencies are: 147.81 MHz in and 147.21 MHz out. The repeater director is Jeff Brennan, WB4WLW.

## Westlink Report

The Westlink report is aired every Sunday night at 8:00PM on the WD4IWG repeater.

## WB4JFI-5 Digipeater

WB4JFI-5 is a 1200-baud AX.25 Level 2 digipeater operating on 145.01 MHz. It is located in northwest Washington DC at Wisconsin Ave. and River Rd. The digipeater is mounted at an elevation of 350 feet on the south leg of the WUSA/WJLA TV tower.

## Data Address

Our CompuServe/Micronet number is [72345,1050].

## AMRAD Computer Bulletin Board System

AMRAD CBBS, (703) 734-1387, is operated by Lawrence Kesteloot, N4NTL. The system accepts calls at 300, 1200 and 2400 baud. The data path settings are 8 data bits, 1 stop bits, and no parity.

## HEX Bulletin Board System

Handicapped Education Exchange is operated by Dick Barth, W3HWN. HEX accepts TDD/300 baud at (301) 593-7033,and 300/1200 baud at (301) 593-7357. ASCII is 8N1

## Affiliations

AMRAD is affiliated with the American Radio Relay League (ARRL), Foundation for Amateur Radio (FAR), Northern Virginia Radio Council (NOVARC) and the Mid-Atlantic Repeater Council (T-MARC).

## AMRAD Newsletter

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